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G. C. GARNETT, M. A., read the following paper on Ancient Gallies; and presented a collection of drawings and photographs to illustrate his paper :—

ON ANCIENT GALLEYS.

THE subject of ancient Gallies, which I have the honour to bring before your notice this evening, is a theme, I believe, which has often engaged the attention of many learned societies, both in our own country and in those parts of the Continent which are most notable to us for their antiquarian and literary researches.

Indeed, to trace the subject from the infancy of naval art would, I believe, be vain; for it is manifest that long before any detailed accounts were written, or at least before our preserved records, a system of naval architecture existed, which was far more complicated in its nature than either the hollow boats from trees (*μονόξυλα*) or rafts joined with leather thongs (*σχεδίαι*).

The first vessel of any importance we read of is the *Argo*, which we know had fifty oars, twenty-five on each side; and, taking a space of four feet as a medium distance between the rowers, we have a length of 100 feet; but in addition to this was the curvature of the bow and stern—a part of the vessel in which Trajan's column exhibits no rowers or ports—and which curve would most probably be not less than seven feet, which would give a length of 114 feet, a size of vessel out of keeping with the mechanical arts of the period.

In addition to this, we know that some were shaped sharp at both ends—in other words, the bow and stern were alike; whence they are called *νῆες ἀμφίπρυμνοι*. Now, it seems highly probable that these vessels were used only for the purpose of river navigation, as their great length would be of inconvenience in turning. These, however, must not be confounded with the true *naves longæ*, a much more recent invention—vessels which had a true bow and stern. To Minerva, the happy mother of the arts and sciences, is ascribed the origin of the naval art; but at what period the idea first had birth is a question of much controversy.

Now, the Homeric poems seem a fit starting point for such an inquiry; yet no source should be disregarded which can afford any information on the subject, and in the Archipelago many vessels are still seen bearing many of the characteristics described by Homer. It was after the Punic war, or 490 A. U. C., however, before the Romans can be said to have possessed any ships of magnitude. They were divided into two classes—merchantmen, “*ἑλκάδες*,” and “*νῆες*,” ships of war. These “*νῆες*” were, it is calculated, at least eight times their breadth in length; they were at first “*uniremes*,” but afterwards were “*triremes*”—to a great extent, no doubt, a generic appellation to all vessels of war, just as we apply the term “*liners*” to vessels of 60, 78, 90, or 100 guns.

The exact form of the original triremes seems doubtful. Those on the “*Columna Rostrata*” of Duilius are in a great measure, no doubt, offsprings of the sculptor's imagination. M. Dupuis Delôme, the

constructor of the "French Imperial Marine" investigated this subject, in order to arrive at a correct model for the French Imperial Galley, lately built at Clichy. M. Jal, the celebrated naval authority, is of opinion that triremes were constructed principally with straight decks—an innovation, certainly, on the more generally received idea of the decks being considerably curved in form. The kinds of woods used were various. The "ornus," a kind of wild ash, and the ilex, or wild oak, were employed to a great extent; the fir was also used—

"Nascitur et casus abies visura marinos."

The Romans were most particular in the wood being dry and seasoned for the purpose. Oars were first used, and indeed used in almost all cases, in the "triremes," sails being left for vessels of mercantile use. The "triremes" possessed, indeed, according to Homer, a true deck; for you cannot allow a hatchway unless you have a deck—

Νηῶν ἱκρι' ἐπώχετο μακρὰ βιβιάσθων—

and again,

—εἰς ἱκρία νηὸς ἔβαινε
Πρώρης—

Mr. Howell, indeed, holds these *ἱκρία νηὸς* to have been the seats or benches upon which the rowers sat; but in my opinion they were merely the raised steps, or separate flights, seen in many models and drawings, and existing in the Trinity College model. These flights were invariably placed at the ends of the Galley, as we place the forecandle and quarter-deck. Indeed, Thucydides says they had no decks—

οὐδ' αὖ τὰ πλοῖα κατὰφρακτα ἔχοντας.

"Neither had they as yet any covered nor decked ships," which clearly shows the centre of the Galley to have been open. Indeed, unless this was granted, it is impossible to find out how the men that were rowing could have breathed, packed as they were in such numbers, the oar ports being so small as to afford no benefit in that way to them.

The fitting of the ancient Galley which has changed least in form from its original design is the "anchor." It was first one-fluked, *ἑτεροτόμος*; but afterwards *ἀμφίβολος*, or double-fluked, was used. In its original form it possessed no upper bar or arm, but merely a shaft and ring. But the most formidable of all the parts of the ancient triremes was undoubtedly the prow, or beak, which was generally of brass. We read, indeed, in the life of Themistocles, that when Ariamenes, admiral to Xerxes—a good man—attacked Themistocles, both ships, meeting stem to stem, and striking each other, their sharp stems, armed with brass, pierced, so indeed that they were fastened together, and could not be separated.

And again, in the Life of Lucullus, we read that, in the Bay of Tenedos, Neoptolemus, the chief officer in command of the Gallies belonging to Mithridates, was attacked by Lucullus, who was on board a Galley of Rhodes, commanded by Demagoras, an expert seaman, whom

when Neoptolemus saw he commanded the master to bear down upon him with all imaginable force ; but Demagoras, fearing the beak and massive stem of the admiral's Galley, refused to meet him ahead ; wherefore, tacking about, he received him astern, in which part, though indeed the shock was very great, he suffered no damage.

Now, this plainly shows that the curvature of the stern must have been at a considerable angle to the water, and that the stem or beak ran as if it were in and under the counter of the Galley. This hollow in the stern was left, no doubt, for the action of the rudder.

The ancients seem to have had no limit to the size of these Galleys. The largest we read of was that of Ptolemy Philopator. This enormous vessel was merely, it has been conjectured, built for show : she had 40 banks of oars ; she was 280 cubits in length, about 420 feet,—the length of the iron-plated frigates, *Minotaur* and *Achilles*.

The subject of frequent dispute is, how these Galleys have been rowed or put in motion. M. Le Roy, in his "*Sur la Marine des Anciens*" (*Academie des Inscriptions*), M. Jal, in his "*Archeologie Navale*," and others of a later period, have made investigations into this subject.

One of the chief obstacles to the settlement of this question is the want of any accurate drawing or bronze existing by which the *interior* of the hull could be seen, with the arrangement of the seats. Few models, indeed, exist. There is one in the Museum of Trinity College, which I consider a most important model. It is a monocrota, or uni-reme ; the boar's head, the distinguishing feature of the Roman triremes, points to its Roman origin. Its length is 9 feet 7 inches ; breadth, 3 feet 4 inches ; and depth, 1 foot 5 inches—of which the underneath is a representation :—

How it came into the possession of Trinity College is a mystery. Neither in Dr. Stokes' nor in Dr. Ball's time (both Curators of the Museum), did any circumstance arise to throw light on this most interesting model's origin.

There is another in the Campaggio at Rome, and some marbles at Naples, in the Museo Borbonico, while a few solitary frescoes have been discovered at Pompeii, in an injured state.—See Zahn and Ternité.

Before I proceed to state the various theories connected with the rowing, I must acknowledge the great kindness of M. Auguste Jal, the eminent historiographer of the French navy, who addressed the following letter to me, through the Consul-General of France for Ireland, Mons. George Livio. It is concerning the Galley lately constructed at

Clichy, on the Seine, for the Emperor of the French, and a photograph of which will be found in the volume of "Ancient Galleys from the Antique," presented by me to the Royal Irish Academy.

To G. G. Pattison, Esq., of the Edinburgh Academy, and George Hill, Esq., of the Royal Antiquarian Society of Scotland, I beg to return my best thanks.

The following is a copy of M. Jal's letter :—

" *Paris, 24 Mars, 1864.*

" MONSIEUR,—La galère impériale-trirème construite près de Paris est à Cherbourg d'où elle ne sortira probablement point. L'Empereur n'en a point fait graver les détails et il n'en existe pas de reproduction photographique, qui au reste n'aurait point d'intérêt dans la question dont il s'agit parce qu'elle montrerait seulement l'extérieur et que ce sont les dispositions intérieures qu'il importe de connaître pour se faire une idée exacte de la position et de l'organisation des rames.

" Mais si aucun portrait ne peut être offert au savant Irlandais qui veut s'occuper des navires à rames de l'antiquité, il existe un petit livre où toutes les questions qui touchent à la construction des galères sont traitées avec tout le soin dont l'auteur est capable, livre qui fut publié par ordre de l'Empereur et à ses frais. C'est celui qui a été consulté lorsque sa Majesté a voulu que M^r Dupuy de Lôme construisît un navire à trois rangs de Rames. Il est intitulé :—

" *La flotte de César, &c.* Par Auguste Jal.

" Il a été publié en 1860 chez Didot, rue Jacob, 56. Je conseille au membre de l'Académie d'Irlande qui fait son étude d'une question qui m'a long-temps occupé et dont je ne me flatte point d'avoir résolu toutes les difficultés, de se procurer le petit volume où il trouvera mon *Virgilius nauticus* à la suite du mémoire sur la flotte de César, et une note sur un Béliet dont se servaient les anciens.

" La connaissance que j'ai pu acquérir des choses de l'antiquité, je la dois à la longue étude que j'ai faite des marines obscures du moyen âge, sur lesquelles j'ai publié en 1840 deux volumes intitulés: *Archéologie navale*. Ce travail est bien connu en Angleterre où plusieurs auteurs l'ont cité et mis à profit.

" Les questions qui intéressent les marines anciennes sont de celles qui veulent de longues études; bien des systèmes ont été proposés qui venant d'hommes étrangers à la marine pratique ne sont point acceptables pour nous dont l'éducation a été celle du matelot et de l'officier. Il faut se défier beaucoup des travaux des savans qui ont examiné seulement les monumens et les textes, mais qui n'ont pu les voir avec les lunettes du marin.

" Si j'avais un exemplaire de *la flotte de César* j'aurais l'honneur de vous l'adresser, mais je n'en ai plus. Les libraires de Dublin le feront venir, et votre ami aura là tout ce que j'ai su de la marine antique, et

malheureusement c'est beaucoup moins considérable que je ne l'aurais voulu.

“J'ai l'honneur d'être, Monsieur,

“Votre serviteur très humble,

“A. JAL.

“Le volume que j'ai l'honneur de vous signaler est orné de gravures, et à la page 156 se trouve une coupe de la trirème avec ses avirons, qui fera fort bien comprendre ce qui a été exécuté dans la construction de la trirème impériale, et qui a très bien réussi,—car la trirème marchait très bien, et elle eût marché mieux encore si les rameurs avaient été de ces *remiges* Romains, des gens que l'habitude de vivre sous et au soleil, et un long usage des rames rendaient si forts et si capables de longues fatigues. Nos matelots de Cherbourg étaient bons et solides, mais quelle différence avec ceux qui maniaient la rame sur la mer Ionienne et sur les côtes de Carthage!”

By the kindness of a friend at Cherbourg, I was enabled to procure a photograph of the French Galley for the Academy, an outline of which is here given, and which has been engraved in the “Illustrated London News.”—

Up to the present time, no fewer than six theories concerning the rowers have been put forward.

The first solution of the question has been founded on a passage from the Emperor Leo, and quoted by Morisotus, in his “Orbis Maritimus:”—

“Every ship must have its due length,

Having two ranks of oars, the one higher than the other.”

The difficulty in this case is manifestly, assuming one range of oars higher than the other, to have been one perpendicularly over the other—a system totally impracticable.

The second theory has been maintained by Stewechius and Castilognus, namely, that the oars were in a broken line—three together, and then a space intervening, and then three again; yet all on the same line. Now, this would entail a great loss of power, and gain no advantage.

The third is that of Sir Henry Saville:—That the oars rose at an angle of 50° to the deck of the vessel, yet having only one bank of oars, each series of steps containing a rower. The objection to this theory seems to be the amount of beam not being in keeping with the term “*naves longæ*,” which were eight times as long as broad.

Vossius’ theory is the fourth, that three men pulled at the same oar; yet in a *πεντηκόντορος*, if this theory is held, 100 men must have stood across the beam of the Galley; and supposing only 50 stood so, and the oars not to be in the same parts of the Galley on each side, we have 8 times 50 (giving each man a foot to stand on), 400 feet, as the extreme length of the rowing part of the Galley, without counting bow and stern curves—a length utterly absurd.

The fifth theory is that of Le Roy, and is certainly a step in the right direction, viz. that the oars were in an oblique line, yet one above, or higher than the other, in a checquer form, but only one man to each oar—a fact irreconcilable with the length of the oars used, 57 feet in Ptolemy’s, for instance, and the weight of lead attached to it.

The sixth and last theory I hold to be the true one: it is that of General Melville,—that the ancient Galleys had a gallery extending round their sides, in which the rowers sat, at an angle of 45° or 50° to the water’s edge. That this gallery exists to a great extent in the Venetian Galleys we know; and that more than one used the oar we learn from Suetonius, who says that the *Liburnæ* of Caligula had ten men to the oar, and that of Caius five.

Montfaucon adds the following in defence of his theory of the Galleys possessing three banks of oars:—“*Supra majorum navium carinam latera in tres partes erant diuisa, quarum inferior, θάλαμος, media ζύγµα, superior θράνος uocabatur; unde remiges quoque diuersa sortiebantur nomina. In inferiori enim gradu qui stabant, eos Thalamitas, in medio Zygitas et in gradu superiori qui collocati erant eos Thranitas uocabant.*”

Some indeed hold the word “*trireme*” to have been a generic name for war vessels of all sizes; that it is exceedingly improbable that more than three rows of oars were ever in use; and that the words “*hexiremes*,” “*quinqueremes*,” &c., were more applied to the size of the vessel than the number of oars; that no vessel of five ranks of oars, one over the other, could be propelled, I believe certain; that the number of men to each oar varied with the size and weight of the oar, I think also to be an indisputable fact.

Dr. Smith says that the *thalamites* were placed immediately under the *thranites*, but covered by the platform or gangway on which the *thranites* sat. That they did not interfere with each other is indeed manifest from Dr. Smith’s experiment, designed by himself, which he

explains in the following terms :—" I cut two oar-ports to represent the row-locks of the zugites, at a distance of 3 feet 6 inches from centre to centre, which is the distance allowed in the launches of a man of war, which are pulled 'double-banked,' or with two rowers on each bench, as in the ancient Galleys; and I found that by cutting an oar-port fourteen inches below those of the upper tier, and about one-third of their horizontal distance, reckoning from bow and stern, a rower seated on the deck, and rowing in the lower port, was not interfered with by the rowers seated on benches nearer the centre of the vessel, and rowing in the upper oar-ports." Whether, indeed, the height of the thranites' oars was only five feet from the water, is still an open question. Dr. Smith, it must be confessed, at least deserves the warm thanks of the antiquarian for taking such a deep interest as he has done in the subject, and aided his great knowledge of these various theories by such a highly interesting and valuable experiment.

The fact of the imperial trireme having been rowed with comparative ease from Clichy to Cherbourg, I think, must also be a conclusive argument against the theory of Sir H. Saville, of only one row of oars existing.

Perhaps, of all the various theories concerning the manner of rowing these Galleys, that of General Melville is open to the least objections; the extended gallery would give facility for using the oars, and its being inclined at an angle of 45° to the water's edge would render the height of the uppermost tier within the bounds of probability. That more than one row, or tier of oars, existed, indeed is evident from the fact, that when two Galleys met in conflict, the oars of the different tiers could be suspended from the outside of the ports, which would have been impossible if they reached within the Galley more than a certain distance, which a great number of hands or rowers would necessitate. Dr. Leonhard Schmitz tells us, that more than three ranks of oars were not in construction in Greece till about the year 400 B. C., when Dionysius, the tyrant of Syracuse, who bestowed the greatest care upon his navy, first built *τετράρεις*, the model of which class of Galley is ascribed to the Carthaginians. The *ἐξήρεις* are ascribed by Polybius to the Syracusans—a fact also mentioned by Ælian.

That when these vessels exceeded a certain size they were practically of no value for war purposes, is indeed evident from their description. Montfaucon, for instance, describes at length the great ship built for Hiero by Archias, which consumed as much timber in her construction as would have sufficed for sixty Galleys of the trireme class. This wood was brought from Mount Etna, Italy, Sicily, Spain, and the Rhone. It took three hundred skilled artizans six months to complete her; and, in order to launch her, they had to invent a machine called a helix. Yet, like Ptolemy's great ship, she was considered a mere hulk upon the water, that was indeed of but little use for any effective purpose.

In conclusion, the rate of these Galleys is not very accurately known. Admiral Beecher, however, is of opinion that a speed of seven miles per hour was the average; and J. Smith, Esq., F. R. S., in his "Shipwreck of

St. Paul," mentions that Adrian set sail about daybreak, and at noon had obtained a distance of 500 stadia,—*καὶ ἤλθομεν πρὸ τῆς μεσημβρίας σταδίου πλείονας ἢ πεντακοσίου*, or more than fifty geographical miles—a speed of at least eight miles per hour.

That, indeed, the subject of Ancient Galleys is of great interest, and one fraught with many difficulties, I think will be acknowledged by every classical student. In the various remarks concerning the manner of rowing these ships, I have not pretended to solve the difficulties; but rather to place in a concentrated form the various theories of the most eminent writers on this subject.

The Secretary of the Academy read a paper, by Lord DE ROS (communicated through the President)—

ON THE CONSTRUCTION OF ANCIENT GALLEYS, AND THE ARRANGEMENT OF THEIR OARS AND ROWERS.

THERE are few subjects which have attracted more notice and discussion among classical students, than the details of the navigation of the Greeks and Romans; and this matter seems doubly interesting, from the probability that in any future naval warfare, we may see practised (though with far more terrible and destructive effect) by the steam rams of late invention, the very same manœuvre of charging "prow to prow" which we read of at Actium and other great sea fights of ancient times.

Propelling by steam, whether by the use of paddle-wheels or screws, brings back, in truth, after the lapse of so many hundred years, the great principles of naval warfare to several of the same conditions which arose from the propulsion by oars; and, indeed, it is only of late years that the speed of steam vessels has been brought to exceed so vastly that of the row Galleys of former times.

In that amusing book, Smollett's "Travels in Italy," about the year 1760, he describes the mode of coasting from Spezzia to Nice by passage boats, rowed with oars, as by no means a tedious way of travelling, when favoured with tolerably smooth water; and the writer of this Paper recollects, when on a military mission to the Black Sea, in 1835, that the "Pluto," a man-of-war paddle steamer, in which he traversed that sea both from E. to W. and from N. to S., took six days for the former, and three for the latter passage; which is the very time mentioned by Strabo as occupied by a Galley of his day in performing her *πλοῦς* of those very same distances in the Black Sea.

It must be mentioned, however, that the "Pluto" was a gun brig converted into a steamer, and of such inferior quality, that, when going at her best speed, seven or eight knots was all she could accomplish. Now, there is no doubt but a Greek or Roman Galley could fully perform that rate, and even more, for short distances, and in smooth water. But to attain any rapid speed with oars, it is scarce necessary to say that the rowers must have good room, and scope for the stretch of arm and play of every muscle. A cramped position, or an ill-balanced